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EXAMINER

SINGH, DALIP K

ART UNIT PAPER NUMBER

2628

DATE MAILED: 03/29/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/815,329

Applicant(s)

DOROJEVETS ET AL.

Examiner

Dalip K. Singh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 August 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-31 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3, 7-11, 14-19, 22-27, 30 and 31 is/are rejected.
- 7) ☒ Claim(s) 5, 6, 12, 13, 20, 21, 28 and 29 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-3, 7-10, 14, 16-18, 22-26, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 6,847,365 B1 to Miller et al in view of US 4,725,973 to Matsuura et al.

- a. Regarding claims 1, 16, and 24, Miller et al. **discloses** configuring a plurality of processing elements (MPE₀, MPE₁...Fig. 3) into a two-dimensional array of processing elements (...media processor 32 comprises a communication bus 60, a main bus 62 and a supplemental (supp) bus 64, all of which are used to connect various processing elements and sub-system units of processor 32.... processor 32 preferably comprises a first processing element (MPE₀) 66, a second processing element (MPE₁)...col. 5, lines 50-60;...although four MPEs are shown, the invention is not limited to any particular number of MPEs and may have as few as one MPE or a large number of them...col. 7, lines 3-10) such that each processing element includes a plurality of vector registers (...for example, to store a vector value that requires 128 bits, four of the 32-bit physical registers are logically combined together. Thus, the first defined logical vector register, V₀ may be stored in physical registers R₀-R₃...col. 14, lines 25-45),, a plurality of scalar registers (...so the lower half of each scalar register 174-180:...similarly, a pixel data type 182 also may comprise four scalar registers 184, 186, 188 and 190...col. 13, lines 30-40; Fig. 6);, and a plurality of arithmetic logic units (...each MPE 66-72 preferably comprises a single instruction stream, multiple data stream (SIMD) internal hardware architecture,

and a Very Long Instruction Word (VLIW) architecture. The VLIW architecture includes a plurality of parallel processing units, such as an arithmetic logic unit, a multiplier unit, etc; so that each processing unit may execute its own instruction on its own data. Thus media processor 32, as discussed above, comprises a parallel architecture, and each of the MPEs 66-72 within media processor 32 also preferably comprises of parallel architecture...col. 10, lines 1-13;...architecture 100 of the MPEs may have a plurality of sub-units, such as an execution control unit (ECU) 106...a register control unit (RCU) 110, an arithmetic logic unit (ALU) 112, a multiplication processing unit (MUL) 114, and a register file 116...col. 10, lines 27-31) wherein a data path of each processing element includes a set of processing element slices each coupled to one arithmetic logic unit (...ECU 106, MEM 108, RCU 110, ALU 112 and MUL 114 all are connected together in parallel via register file 116...col. 10, lines 32-35) such that each arithmetic logic unit (ALU 112) receives a specified portion of each vector register as input (...ALU 112 performs arithmetic and logical operations on data that typically is stored in register file 116, and also may be optimized for pixel operations...col. 11, lines 14-25;...Fig. 6, a diagram illustrating the various data types that are supported...by each MPE 66-72...the simplest data type is a scalar type 160...for example, a vector data type 162 may comprise four 32-bit scalar data types...col. 13, lines 22-51;...For example, R0-R3 may be combined to store a first pixel,....and R12-R15 may store a vector...col. 14, lines 24-45;...ALU 112 is flexible because the inputs and outputs of ALU 112 may be directed to and from a variety of different sources...col. 16, lines 47-67;...Fig. 10 is a diagram showing how an MUL unit 214 processes a pixel or small vector data type...col. 17, lines 57-67); configuring a video stream into data blocks (...the invention is directed to a novel processing architecture. that can decompress and process video data...the compressed media stream, that may include audio and visual data, enters a media processing system

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30...col. 3, lines 33-64...the operation of processor 32 will be explained by way of an example of processing an MPEG video data stream...col. 6, lines 49-67); loading the data blocks into the plurality of vector registers within each processing element (...As shown,...pixel maps are 16 bits, and may be stored in DRAM...loaded into MPE registers...Pixel map type 4 has 32 bits per pixel...this type of pixel map may be stored in a vector register...col. 16, lines 10-35); processing the read portions by the arithmetic logic units such that the data blocks from the plurality of vector registers are processed in parallel (...this particular parallel bus structure permits an increased amount of data to be processed by media processing system 30...col. 6, lines 22-30). Miller et al. **implicitly discloses** plurality of block registers which function similar to vector registers (Specification of the instant application at paragraph 17 discloses vector or block registers holding data blocks). However, Miller et al. **fails to disclose** reading the specified portions of each vector register by each of the corresponding arithmetic logic units within all processing elements simultaneously. Matsuura et al. **discloses** concurrent execution of the vector instruction by a plurality of arithmetic logic units (...and these two element series are simultaneously read from the vector register array and are concurrently processed by two arithmetic logic units; then the results obtained from these two arithmetic logic units are simultaneously written in the vector register array...col. 3, lines 13-28). Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to modify the device as taught by Miller et al. with the feature "simultaneous read or write operations by arithmetic logic units" as taught by Matsuura et al. **because** it provides for improved processing time of data.

b. Regarding claims 2, and 17, Miller et al. **discloses** wherein loading the data blocks into the plurality of vector registers, reading the specified portions of each vector register, processing the read portions, and writing the results of the processing is

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performed within one processing element clock cycle (...thus, an entire pixel or small vector may be multiplied by a second entire pixel or small vector in a single clock cycle using MUL unit 114, thus increasing the processing speed of the media processing system for graphics applications that use pixels...col. 18, lines 1-10).

c. Regarding claims 3, 10, 18, and 26, Miller et al. **discloses** wherein each arithmetic logic unit is further configured to receive the contents of one of the scalar registers as input (...ALU 112 performs arithmetic and logical operations on data that typically is stored in register file 116...col. 11, lines 14-25).

d. Regarding claims 7, 14, 22, and 30, Miller et al. **discloses** register file 116 being used to temporarily store data that is being processed by any of processing units 106-114, and functions as block registers of the instant claim (...Register file 116 may be used to temporarily store data that is being processed by...processing units 106-114 in the MPE. For example, when two numbers are added together, each number may be loaded into registers in register file 116, and then the registers are added together with the result being stored in a register...register file 116 may be reconfigured to store various different types of data, including video processing specific data types, such as pixels...col. 10, lines 45-53).

e. Regarding claims 8, and 23, Miller et al. **discloses** ALU unit 112 returning data back to register file 116 (...As shown in Fig. 4, ALU unit 112 and MUL unit 114 both can return data back to register file 116 via return register file ports 126 and 128 respectively, so that the result data may be stored in one of the register file registers...col. 11, lines 22-25).

f. Regarding claim 9, Miller et al. **discloses** a main memory (element 46, Fig. 2); and the rest of the instant claim limitation is similar to claim 1 above and is rejected under the same rationale.

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- g. Regarding claim 25, it is similar in scope to claim 9 above and is rejected under the same rationale.
3. Claims 4, 11, 19, and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 6,847,365 B1 to Miller et al in view of US 4,725,973 to Matsuura et al. as applied to claim 1 above, and further in view of US 5,226,171 to Hall et al.
- a. Regarding claims 4, 11, 19, and 27, Miller-Matsuura combination **fails to disclose** wherein when the contents of one of the scalar registers is used as input, a scalar register value is broadcast from the one scalar register to all arithmetic logic units within a given processing elements. Hall et al. **discloses** column elements of a matrix M being broadcast to all the arithmetic units (...the arithmetic unit also includes a first set of four vector registers 48 and a first set of scalar registers 50 which selectively receive data input from the bus means 40...col. 4, lines 9-15;...the same column elements of a matrix M (at 36 in Fig. 3) are broadcast to all the arithmetic units employing synchronous memory bus means...col. 4, lines 59-67;...as hereinbefore indicated, a common input operand may be broadcast to a plurality of the arithmetic units 16-30, with each one performing calculations with respect to data theretofore stored therein...col. 5, lines 44-49). Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to modify the device as taught by Miller_Matsuura combination with the feature “scalar register value being broadcast to all arithmetic logic units” as taught by Hall et al. **because** this provides for substantial size calculation to be performed resulting in faster processing (col. 5, lines 1-2).
4. Claims 15 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 6,847,365 B1 to Miller et al in view of US 4,725,973 to Matsuura et al. as applied to claim 9 above, and further in view of “*A bit-serial VLSI array processing chip for image processing*”

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Heaton, R.; Blevins, D.; Davis, E.; Solid-State Circuits, IEEE Journal of Volume 25, Issue 2, April 1990 Page(s): 364 - 368 Digital Object Identifier 10.1109/4.52157.

a. Regarding claims 15 and 31, Miller-Matsuura combination **does not disclose** wherein each processing element comprising a mask register to exclude processing of the processing element. “*A bit-serial VLSI array processing chip for image processing*” *Heaton, R.; Blevins, D.; Davis, E.; Solid-State Circuits, IEEE Journal of Volume 25, Issue 2, April 1990 Page(s): 364 – 368 discloses* when a “maskable” instruction is issued, all PE’s whose G bits are set to zero will be masked and will not perform the broadcast operation, All other PE’s, with their G registers set, will execute the instruction normally (see Fig. 7). Using this approach, PE’s can be selectively enabled and disabled. Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to modify the device as taught by Miller-Matsuura combination with the feature “selective enabling and disabling of PE’s” as taught by “*A bit-serial VLSI array processing chip for image processing*” *Heaton, R.; Blevins, D.; Davis, E.*” **because** it provides for efficient use of PE’s resulting in efficient PE operations.

Allowable Subject Matter

5. Claims 5, 6, 12, 13, 20, 21, 28, and 29 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Prior art fails to disclose wherein each processing element further comprises a local accumulation register to accumulate the results of the plurality of arithmetic logic units within the processing element, further wherein each processing slice is coupled to a slice accumulator such that each slice accumulator buffers the results from any one of the local accumulation registers corresponding to the processing elements of the processing slice; and further comprising accumulating the results of each slice accumulator into a global accumulator register. US 6,601,077 B1 to Aldrich et al. **discloses** a

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DSP unit for multi-level global accumulation (..the DSP 100 includes...an arithmetic logic unit (ALU) 165, and an accumulator 175...col. 1, lines 63-67) but **fails to disclose** slice accumulator buffering the results from any one of the local accumulation registers corresponding to the processing elements of the processing slice and accumulating the results of each slice accumulator into a global accumulator register.

Conclusion

6. The following prior art made of record but not relied upon is pertinent to the invention. US 6,366,998 B1 to Mohamed (Reconfigurable Functional Units for implementing a hybrid VLIW-SIMD programming model); US 6,820,102 B2 to Aldrich et al. (DSP unit for multi-level global accumulation); US 5,729,758 to Inoue et al. (SIMD processor operating with a plurality of parallel processing...); US 4,633,389 to Tanaka et al. (Vector processor system comprised of plural vector processors); US 6,138,136 to Bauer et al. (Signal processor); US 5,019,969 to Izumisawa et al. (Computer system for directly transferring vector elements from register to register using a single instruction); US 6,809,422 B2 to Saito et al. (One-chip image processing apparatus).
7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Dalip K. Singh** whose telephone number is **(571) 272-7792**. The examiner can normally be reached on Mon-Friday (10:00AM-6: 30PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Ulka Chauhan**, can be reached at **(571) 272-7782**.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private

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PAIR system, please contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Please note that the new Central Official FAX number for application specific communications with the USPTO is **571-273-8300** (effective July 15, 2005).

Dalip K. Singh
Examiner, Art Unit 2671

dk
March 14, 2006

ULKA CHAUHAN
SUPERVISORY PATENT EXAMINER

A handwritten signature in black ink, appearing to read "Ulka Chauhan", written in a cursive style.